

Featured Article

Revisiting the Digital Divide in the COVID-19 Era

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Abstract *The digital divide limits opportunities for those without ready access to Internet. Movement online of essential activities during COVID-19 took inadequate Internet service from inconvenient to emergency/crisis for many households. A negative correlation between rurality and Internet speed was found at the county level, highlighting the struggle for rural areas. Schools tackle challenges of providing equitable educational access by attempting to provide access for students, while even households with service available struggle to maintain sufficient speeds and/or can afford it. Essential activities moved online, yet sufficient Internet is an essential public service that remains unattainable for many US households.*

Key words: COVID-19, Internet access, Public utility, Rural development, Rural internet.

JEL codes: Q13, R11, C54.

Introduction

Due to social distancing guidelines and regulations/restrictions in place in response to COVID-19, the US public has increasingly relied on access to the Internet for information, work, school, and social support. US residents are adjusting to changes in their everyday lives. Changes in communication and connectivity, along with communication technologies, during the pandemic when much of the country was staying at home remain largely underappreciated with respect to how they reshaped everyday living. Many aspects of life remain significantly altered and will remain heavily reliant on the Internet for some time to come, due to social distancing. This article seeks to revisit the digital divide in Internet access, speed, and capabilities, especially highlighting challenges for rural regions of the US that often have poorer Internet services available. Existing literature and data are employed to document the known challenges faced by those with insufficient Internet service and expand upon those concerns considering changes in our society

in response to the ongoing COVID-19 pandemic. The result is an intentional “call to action” for research and public policy to address the pressing need to facilitate sufficient Internet connectivity for US residents. The need is especially great for rural residents facing known connectivity challenges prior to increased pressure in the pandemic era. From schooling to employment opportunities to seeking medical advice, the Internet has become a lifeline for citizens during the COVID-19 pandemic era.

Widening of the Digital Divide Heightens Challenges, Especially for Rural Residents

Access to the Internet in many rural areas is nonexistent or severely limited, which has been problematic for years (Perrin 2019) but arguably never as acutely painful as during the COVID-19 pandemic, when getting online became (for many people) compulsory. Rural areas without sufficient Internet connectivity and services face challenges including a brain drain of talent, skills, training/development, and jobs/telework, lack of access to telemedicine, limitations of distance learning (Hennessy, Läpple, and Moran 2016; Thompson 2020), and lack of ability to employ precision agriculture technology and use data in farm and rural industries (Smith 2020). For many rural residents, Internet speed is the common challenge, but for an alarming number of people access (at any speed) remains elusive without turning to satellite or other costly and cumbersome options. Only 51.6% of rural U.S. residents had 250/25 megabits per second (Mbps) internet access in 2018 compared to 94% urban residents (FCC 2020a), a broadband speed reported upon by the Federal Communications Commission that would support a household with four devices under the FCC’s definition of moderate usage (FCC 2020).

Multiple devices and users within a household often cannot be supported at the speeds required to effectively participate in school or work activities. In residential networking environments, a customer may share Internet throughput or bandwidth with many other neighbors in the community and this can affect Internet speeds as well. Thus, while Internet service providers often advertise Internet at one speed, actual Internet speeds experienced by the residential customer can be much lower (George 2019). These differences in actual Internet speed compared to advertised speeds can have a variety of causes, including access during peak usage times, subscriber hardware, provider infrastructure, and distance to servers (Hoffman 2017). It is common for internet service providers to stipulate within service performance agreements and disclosures embedded in the terms and conditions of service that a particular amount of bandwidth is guaranteed (such as those in service-level agreements for business operations [Bourbiel 2019]). However, the Internet speeds for residential customers may only reach up to the advertised speed but it is not guaranteed, and actual speeds may vary (Comcast 2020). In many cases, residential Internet is restricted on “best-effort service agreements” while business Internet is faster, has more features (such as security for payment transactions or for hospitals transmitting sensitive data), and other benefits (Verizon 2017). In rural areas with aging infrastructure, simply having a few neighbors sharing the Internet at the same time can further exacerbate the issue (Kuchinsky 1996; Park, Freeman, and Middleton 2019).

The COVID-19 pandemic has not exacerbated congestion problems with more people working via the Internet and also decreased Internet speeds

worldwide (Armstrong 2020; Chen 2020). Home Internet connections with lower bandwidth are simply not able to support the multitasking demands of a household equipped with many technological devices (Beaunoyer, Dupéré, and Guitton 2020). Homeschooling children while adults are working online may be impossible for residents of many communities in the US due to Internet bandwidth constraints, leading to staggering internet usage (Alba and Kang 2020). However, staggered Internet usage is impossible in a scenario where online attendance is required at a specific date/time. Negotiating Internet access within the home is challenging and has led to public concern for children, particularly those with fewer technological resources or unreliable Internet access, falling behind educationally during this crisis (Cullinane and Montacute 2020; Frenette, Frank, and Deng 2020; Lourenco and Tasimi 2020). Although schools and public places, such as libraries, are increasingly offering wireless Internet access to children for schooling purposes, rural residents face further challenges due to distance required to travel to public access points.

The availability of broadband access (and associated cost) for rural residents varies significantly at the county, township, or more microlevel geographic designation; publicly advertised Internet speeds and associated costs are provided in Table 1 for reference. But paying for sufficient service is a concern for many people. In a study by Lai, Widmar, and Bir (2020), 8% of respondents in their representative sample of Indiana residents indicated that they pay for home Internet in addition to paying for mobile hotspot capabilities for supplementary/secondary access. Armstrong (2020) compiled a listing of temporary no-cost internet services for low-income residential households, many of which have strict eligibility requirements (such as being a new customer with K–12 or college students). Many residents with home Internet available have only one service provider option, especially in rural areas. The lack of competition for Internet services forces consumers to accept the limited or insufficient technological offerings provided in their area, further increasing or reinforcing the digital divide.

Table 1 Selected Internet Service Providers' Lowest Advertised Speeds for Residential and Business Internet

	Residential home		Commercial business	
	Price	Speed	Price	Speed
CenturyLink	\$49/month	Up to 10 Mbps	\$49/month	Up to 140 Mbps
AT&T	\$59.99/month	1,000 Mbps	N/A	N/A
Comcast	\$20/month	Up to 25 Mbps	\$70/month	Up to 35 Mbps
Cox Communications	\$19.99/month	Up to 10 Mbps	\$74.99/month	Up to 50 Mbps

Note: AT&T advertises 1,000 Mbps; however, the company states that the expected download speed is only 940 Mbps and goes on to note that "Speed/time examples are estimates and based on wired connection to gateway. Internet speed claims represent maximum network service capability and based on wired connections to gateway. Actual customer speeds are not guaranteed and may vary based on several factors." The company explains that the factors include internet delivered over aging copper lines and traffic on the network impacts speeds. Some internet service providers advertise that 25 Mbps is only suitable for 1–2 simultaneously connected devices streaming "light content."

Based on data publicly available from Measurement Lab (MLab), the world's largest open Internet performance measurement platform, fifteen states in the US have median download speeds of less than 25 Mbps using internet speed tests collected from 7.2 million individual households from December 30, 2019 through June 30, 2020 (Measurement Lab 2020). Speeds less than 25 Mbps can only support one or two devices simultaneously and households with multiple users would require over 50 Mbps to stream high-quality content (Willcox 2019; Auctiontec 2020). During the same time-frame, the MLab data also includes 102 million network diagnostic tests (Internet speed tests) across the US broken down by county. Paring county speed test data with the Rural-Urban Continuum Code (RUCC) (U.S. Department of Agriculture – Economic Research Service (USDA-ERS) 2019), we were able to calculate a correlation coefficient to investigate the relationship between speeds and rurality. Median Internet download speeds were collected for each county and adjusted for geolocated Internet protocol (IP) addresses and aggregated by IP address daily (to adjust for skewness or bias resulting from multiple tests by the same user in the same day). The RUCC is a classification system that allows researchers to distinguish counties by their population size for metro and nonmetropolitan areas using levels from one to nine—the lower the number the higher degree of urbanization. By calculating the correlation coefficient (r) between county-level download speeds and the RUCC, we were able to identify that as a county's RUCC code increases in rurality, Internet download speed has a moderately negative relationship ($r = -0.49$).

In rural areas, COVID-19 has intensified the challenges that come with the lack of Internet access, which has been noticed by many technology companies. Telecommunication providers have pledged (FCC Keeping Americans Connected) to assist struggling customers in maintaining Internet access on a temporary basis; a few providers went further, lowering subscription costs, while others recognized the strain on residential bandwidth and increased Internet speeds for their customers (Hachman 2020). Meanwhile, in rural areas, reliable Internet at home is not an option for some residents regardless of price (Associated Press 2019).

COVID-19 Pandemic Era Adjustments and Public Policy Implications

Advantages afforded by broadband services in rural areas, in particular, have included enhanced home businesses (Anderson, Wallace, and Townsend 2016), reduced depopulation (LaRose et al. 2007), and higher farm sales and profits (Kandilov et al. 2017). The availability and adoption of broadband service with higher download speed was documented by Whitacre, Gallardo, and Strover (2014) to contribute to economic growth through higher median household income, lower unemployment, and positive impacts for rural businesses. Many policy changes have been adopted, albeit heterogeneously, by major Internet service providers in the US in response to COVID-19, including suspending data limits or increasing speed, among others. However, the ability to access and afford service at one's home and/or the ability to access Internet through other means (i.e., virtual schooling children using public Internet in parking lots or other access points) remains a challenge for many households, especially rural households.

As school districts have been forced to tackle the problems that Internet access has caused with equitable access to education by children they have

adopted practices to attempt to mitigate the harm caused by insufficient or nonexistent access. Some school districts have also placed school buses on rotating schedules to provide temporary wi-fi hotspots to students within 150 to 200 feet of busses and support distance learning (Ruffo 2020). Distance learning is a vital resource that many families need, but they may need Internet access to successfully research and ultimately find these resources. In addition to school busses, Internet access has also been made publicly available to families with students in other places such as libraries (Thompson 2020), fire departments (Janny 2020), and institutions that have education's roaming wireless access service (eduroam) (InCommon 2020). Provision of access to students can aid in lessening the divide between students with and without sufficient internet connectivity. However, access in a parking lot without bathroom facilities available and/or undertaking schooling in one's car creates a variety of additional challenges from supervision/parental availability to assist children in these locations to transportation costs and/or time available. Furthermore, the limited range of hotspots on busses or through other mechanisms remains more challenging in rural settings where children are spread further apart.

Longer-Term Implications for Public Investment, Public Services, and Public Policy

On the supply side of conversations about rural low Internet adoption rates, the expense of the infrastructure, and tractability of providing services to more residents, both physically and economically, all remain concerns. Many of the supply-side issues highlighted could potentially be alleviated through greater competition, infrastructure improvements and investments, and regulation/policymaking. As highlighted by Lai, Widmar, and Bir (2020) new infrastructures could include the introduction of redundant cabling to reduce downtime and increase network reliability, as well as take advantage of network redundancy strategies, such as link aggregate, to negate impacts of failures at a single point. Nonfixed satellite-based connections and other new technologies could bring broadband into difficult to reach areas where terrain (mountains) previously limited services. It can be argued that the demand for Internet has increased, although the willingness and ability to pay for access may be hindered for many financially strained or at-risk households (such as those facing financial stress, unemployment, limited economic opportunities, or illness experienced in the household).

The necessity of Internet access, with rapid transformation of many activities due to COVID-19, brings to question the "public" aspects of internet accessibility as a public utility or public good, in the traditional economics sense. Admittedly, the unprecedented speed of transition to reliance on the internet recently is unique. However, the funding and provision of public utilities to rural America, with all of the associated economic and logistical challenges associated, is not novel. One only needs to look to rural electrification for an example — the provision of electric services to rural homes through electrical cooperatives and other unique rural service provision mechanisms. One must question the level of provision of Internet access as a public good versus as a private good, at least in the sense of the availability of the service capable of meeting moderate usage by the average American household and its several modern Internet connected smart devices.

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